SEI Investment Management Unit

Executive Summary

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Efficiency is in the Eye of the Beholder

SEI's Approach to Strategic Asset Allocation

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- A careful definition of both risk and reward is at the heart of SEI's strategic asset-allocation process.
- We adopt a total portfolio approach, which gives the asset allocation process the degrees of freedom necessary to harness the full power of diversification.
- This approach employs a flexible optimization framework, where several perspectives—including forward-looking assumptions and empirical data—and several types of efficiency metrics influence the overall asset allocation.
- By using a more adaptable optimization framework, including alternatives to the mean-variance framework, and a total portfolio approach, investors' goals and attitudes about risk can be reflected in the portfolio construction.

SEI's strategic asset allocation process focuses on creating close alignment between portfolio construction and the way investors judge a portfolio's success. Recognizing that different types of investors will have diverse goals and unique measures of success, SEI takes a flexible approach to creating efficient portfolios. This means there is not a single, rigid formula that determines an optimal portfolio, but rather, an emphasis on choosing portfolio construction methods that are in line with investors' mindsets and expectations.

Portfolio efficiency, in the traditional sense, seeks the highest expected return for a given level of expected volatility, or equivalently, the lowest expected volatility for a given level of portfolio return. It is this archetype of portfolio efficiency that gives rise to traditional portfolio theory's "mean-variance" approach to portfolio construction, and its well-known efficiency metric – the Sharpe ratio. While the mean-variance framework represents perhaps the most foundational relationship for establishing efficient portfolios, it is still only one of many possible relationships that may be used to judge efficiency. The generalized relationship at the heart of the asset allocation process is the relationship between risk and reward. And a careful definition of each—risk and reward—is at the heart of SEI's philosophy for a flexible approach to asset allocation.

In order to define the risk-reward tradeoff in a way that is more meaningful to the end-investor, SEI uses alternatives to traditional measures of efficiency. Portfolio efficiency is defined differently depending on the investment goal and is often measured using a variety of metrics. While expected return and volatility are clearly relevant to any investor, in many cases the way that "reward" is defined, and the "risk" that most concerns investors, can be better captured with more specialized definitions. For example, in addition to Sharpe ratio, SEI considers efficiency metrics that incorporate risk as measured by the size of a potential peak-to-trough loss. This helps to capture the practical implications of what it means for an investor to take risk. More specialized ways of measuring efficiency can be employed for designing portfolios that meet more specialized investment objectives (Exhibit 1).

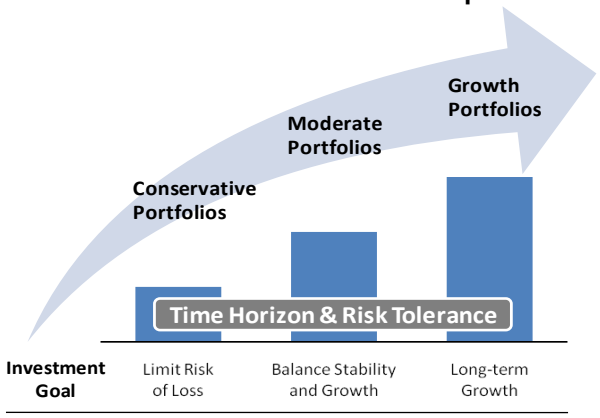
Exhibit 1: Example Asset Allocation Frameworks

Investment Objective	Reward	Risk	Efficiency Metric (e.g. Ratio of Reward / Risk)
Retirement	Sustainable withdrawals to fund retirement	Running out of money prematurely (Shortfall)	[Size of sustainable withdrawal] / [Probability of shortfall]
Protect purchasing power	Positive real (inflation-adjusted) returns	Volatility of real (inflation-adjusted) returns	[Average real return] / [Standard deviation of real returns]

SEI's portfolio construction approach recognizes that investors typically have multiple objectives and different attitudes about risk depending on each goal (see Exhibit 2 for examples). In the simplest example, investor attitudes about risk change from one end of the risk spectrum to the other. Conservative investors with

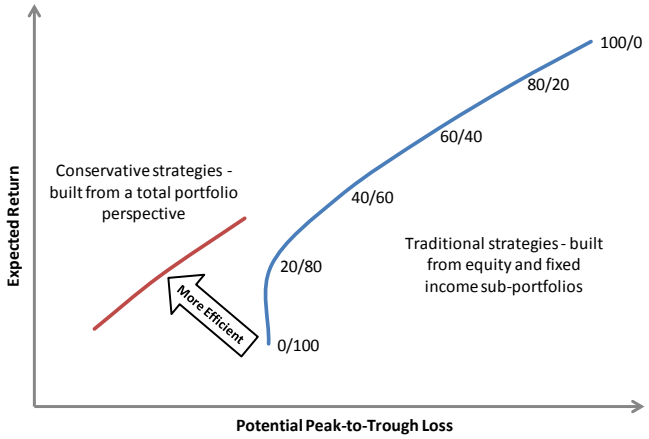
shorter time horizons are focused on stability and avoiding losses, and therefore, tend to be most concerned with absolute risk. Absolute risk refers to the total level of risk measured on a stand-alone basis, or measured relative to so-called risk-free investments, such as cash or Treasury Bills. Conversely, long-term investors focused on growth tend to have a relative-risk orientation. Relative risk measures only the part of risk that is associated with the difference in performance between the investment and its relevant benchmark.

Exhibit 2: Goals Across the Portfolio Spectrum



SEI strongly believes in following a total portfolio approach to meet investor goals. Some traditional approaches build separate fixed-income and equity portfolios, then blend them together to create models across the risk-return spectrum. In our view, this is a sub-optimal approach. Constructing total portfolios from two separate sub-portfolios ignores the interactions between the unique assets from each sub-portfolio and assumes the sub-portfolios are one-size-fits-all across the risk-return spectrum. Exhibit 3 illustrates how a total portfolio approach can capture efficiencies that are often lost when constructing sub-portfolios in isolation—most notably on the conservative side of the spectrum.

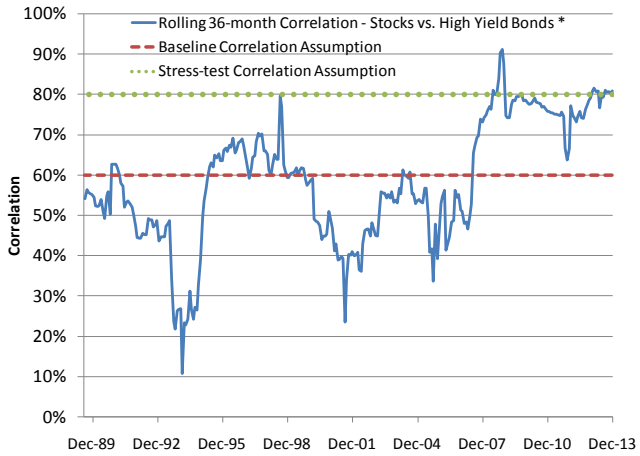
Exhibit 3: Efficiency through Flexibility



Considering all assets simultaneously gives the asset allocation process the degrees of freedom necessary to harness the full power of diversification. Adopting a total portfolio approach allows different goals and metrics to drive the asset allocation process, and allows the use of different assets at different points along the curve. For example, shorter duration fixed income and low-volatility equity can be used in conservative portfolios, while more traditional equity and fixed-income assets can be used elsewhere. The total portfolio approach also facilitates appropriate allocation to "hybrid" assets, such as high-yield bonds, emerging-market debt and multi-asset strategies.

SEI creates capital market assumptions (CMAs), which offer forward-looking views of asset class behavior. All assumptions and economic scenarios are regularly reviewed to ensure that an appropriate range of potential market environments is considered. Rather than using the baseline assumptions alone, asset allocation models are also evaluated under "stress-test" scenarios to ensure that portfolios are robustly diversified. Stress-tests can simulate a shock to capital markets by raising correlation or risk assumptions or both, and assessing the impact on the portfolio. Return expectations can also be adjusted to reflect various market environments, such as the post-financial-crisis, zero-interest-rate-policy environment, in which a stress test may reduce return expectations across some fixed-income assets. Exhibit 4 demonstrates how SEI's baseline and stress-test correlation assumptions account for the dynamic nature of correlations through time.

Exhibit 4: Baseline and Stress-test Scenarios

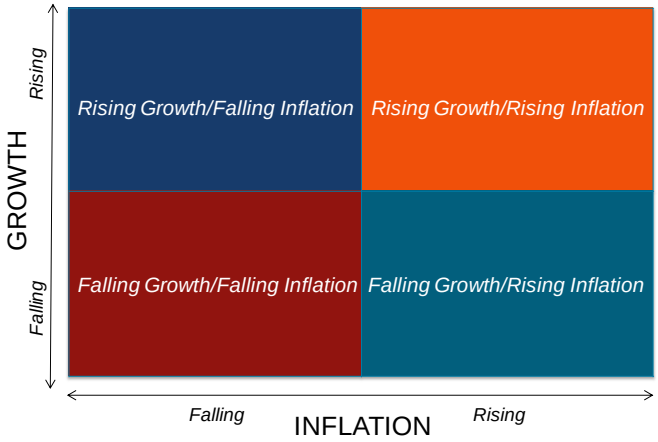


* Stocks are represented by the S&P 500 and High Yield Bonds are represented by the BofAML High Yield Master Index.

In addition to forward-looking CMAs, SEI uses historical data to gain additional perspective in determining what asset class mixes will produce the most robust portfolios. Historical data allows us to observe and measure portfolio behaviors that are not typically captured by CMAs, such as a model's average drawdown[1], its performance during recessionary versus expansionary economic environments and inflation sensitivity over time. The historical data can be used to create back-tests, which give a more intuitive view of an asset-allocation model's potential performance characteristics. Backtests can offer useful insight into how a model might react to specific market environments.

A host of metrics are calculated during the optimization process, including traditional metrics, such as return and standard deviation, as well as non-traditional metrics, such as inflation beta or an "all-season score." All-season score is a bespoke statistic that measures how consistent a portfolio's performance is across different economic regimes as defined by trends in economic growth and inflation (Exhibit 5).

Exhibit 5: Economic Regimes



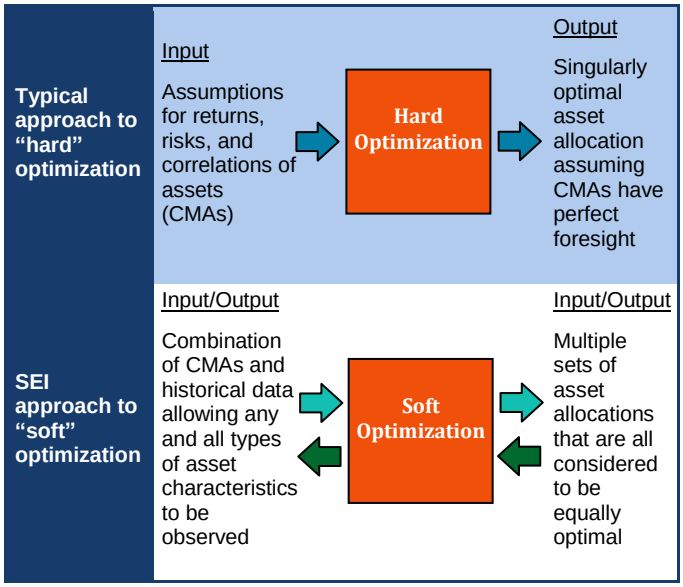
[1] Drawdown refers to a decline in an asset's value from any peak to any trough. The figure that's most often quoted is the maximum, or worst, drawdown. Average drawdown is the average of the worst drawdowns that occurred during separate market cycles. The average drawdown measurement sheds light on the severity of the drawdowns that lurk beneath the maximum drawdown. For example, over three market cycles, an asset that experiences a 20%, 10%, and 10% drawdown, and an asset that experiences a 20%, 20%, and 20% drawdown will both have a maximum drawdown of 20%; however, it's clear that the second asset has more drawdown risk than the first – and the average drawdown measurement will reflect this.

New Approach to Old Challenges

A strict, or "hard" optimization, solves for a single solution to a problem. While this is a convenient analysis, it often exaggerates small differences in the inputs and suffers from over-fitting or data-mining. A more useful exercise is a "soft" optimization, where a wide range of highly-optimal solutions are produced for consideration. Solving for a single solution relies too heavily on precision of the inputs to the optimization. In contrast, evaluating a wide range of portfolios allows for meaningful gains in efficiency to be captured, while not relying on an unrealistic level of precision.

Allowing wiggle room around asset class or portfolio expectations, rather than attributing absolute certainty to point estimates, paints a picture of competing portfolios—each optimal under slightly different scenarios. Some thoughtful reflection on this picture can provide more information for making better asset-allocation decisions. The range of optimal portfolios can shed light on which assets diversify well, and which assets may be good substitutes for one another. The additional information can serve as guidance for setting constraints (e.g., geographical or asset class constraints) and generally is helpful in making qualitative adjustments that lead to the final allocations in a portfolio. A contrast of these approaches is shown in Exhibit 6.

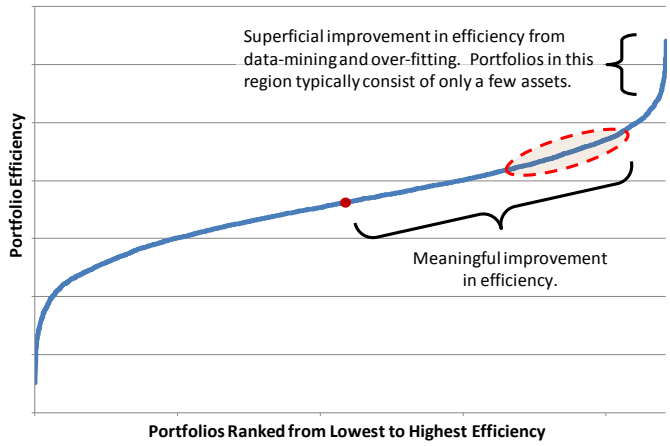
Exhibit 6: Illustration of Optimization Methods



Generating a range of soft-optimal portfolios can be accomplished by varying the inputs in order to produce various outputs, or vice versa, varying the outputs and observing the implications for the inputs. In other words, soft optimization can account for a margin of error around the inputs to the process, effectively softening the edges of the CMAs (or other portfolio metrics) and producing multiple sets of corresponding asset allocations. Alternatively, multiple sets of asset allocations can be generated and assessed, in order to find the portfolios that produce the most favorable range of portfolio characteristics.

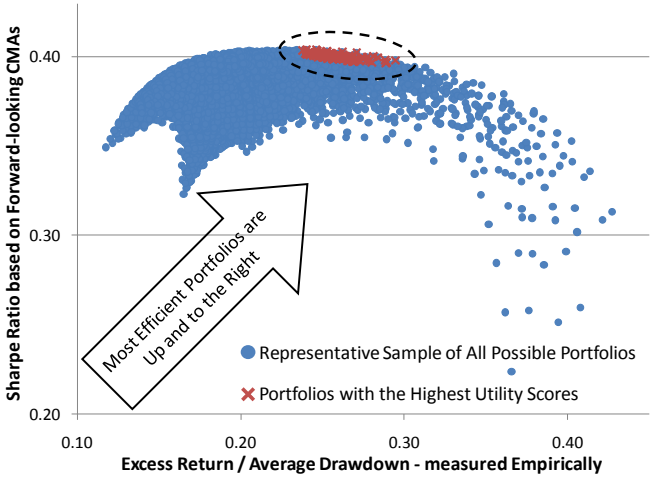
The latter example—starting with multiple sets of asset allocations—entails generating a representative sample of all possible portfolio combinations. This set of asset allocations, spanning the universe of eligible portfolios, can then be ranked according to the desired efficiencies. As highlighted by the shaded area in Exhibit 7, particular focus is given to the range of highly-efficient portfolios.

Exhibit 7: Identifying the Most Efficient Portfolios



This approach provides a very flexible optimization framework, where several perspectives—including forward-looking CMAs and empirical data—and several types of efficiency metrics can influence the overall asset allocation. Asset allocation models can be jointly optimized based on more than one efficiency metric at a time. Two, three, or even four factors can be considered and weighed by a utility function that blends the factors into a weighted utility score. The weightings can easily be adjusted to strike the right balance among the sought-after portfolio characteristics. Exhibit 8 demonstrates one such example where Sharpe ratio and Excess Return over Average Drawdown are both considered. The shaded area highlights portfolios that the utility function has identified as having the most favorable combinations of both metrics.

Exhibit 8: Multiple Perspectives on Efficiency



The ratio of 'Excess Return over Average Drawdown' is similar to a Sortino ratio or Calmar ratio. It uses excess return over the risk-free rate in the numerator and average drawdown, rather than maximum drawdown, in the denominator.

Because there is, potentially, a very large number of portfolio combinations, a utility function makes it easier to sift through the data and locate the best portfolios. A simple, visual inspection of the results, such as displayed in Exhibit 8, can quickly confirm the efficacy of the utility function, or be used as the basis for adjusting it. With the best portfolios identified, commonalities among these leading candidates will find their way into the final recommended allocations. And differences can be exploited to help determine the source or destination of funds when qualitatively allocating more or less to a given asset.

SEI's strategic asset allocation process does not attempt to reinvent the wheel, but instead, takes a new approach to a familiar portfolio construction strategy. By using a flexible optimization framework, including alternatives to the mean-variance framework, and employing a total portfolio approach, SEI can more accurately reflect investors' goals and attitudes about risk. Combining all of these factors makes for what we believes is a more robust and thorough strategic asset allocation process that results in a truly diversified portfolio.

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SIMC develops forward-looking, long-term capital market assumptions for risk, return, and correlations for a variety of global asset classes, interest rates, and inflation. These assumptions are created using a combination of historical analysis, current market environment assessment and by applying our own judgment. In certain cases, alpha and tracking error estimates for a particular asset class are also factored into the assumptions. We believe this approach is less biased than using pure historical data, which is often biased by a particular time period or event.

The asset class assumptions are aggregated into a diversified portfolio, so that each portfolio can then be simulated through time using a monte-carlo simulation approach. This approach enables us to develop scenarios across a wide variety of market environments so that we can educate our clients with regard to the potential impact of market variability over time. Ultimately, the value of these assumptions is not in their accuracy as point estimates, but in their ability to capture relevant relationships and changes in those relationships as a function of economic and market influences.

The projections or other scenarios in this presentation are purely hypothetical and do not represent all possible outcomes. They do not reflect actual investment results and are not guarantees of future results. All opinions and estimates provided herein, including forecast of returns, reflect our judgment on the date of this report and are subject to change without notice. These opinions and analyses involve a number of assumptions which may not prove valid. The performance numbers are not necessarily indicative of the results you would obtain as a client of SIMC.

We believe our approach enables our clients to make more informed decisions related to the selection of their investment strategies.

For more information on how SIMC develops capital market assumptions, please refer to the SEI paper entitled *"Executive Summary: Developing Capital Market Assumptions for Asset Allocation Modeling."* If you would like further information on the actual assumptions utilized, you may request them from your SEI representative.